Incremental dispensing device.

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Abstract of **EP0490555**

A fluid actuated dispensing device (5) having a valve assembly (77) and an actuating piston (78) provides incremental movement of a drive piston (61) within a tube holder. The valve assembly (77) includes a trigger piston (80) and a valve ball (81) biased into engagement with a valve seat. A trigger is adapted to engage the trigger piston (80) and urge the valve ball (81) away from its seat to allow fluid to enter an actuating chamber. The increase in fluid pressure within the chamber drives an actuating piston (78) from an initial position to an extended position in the chamber. The actuating piston is adapted to drive a washer (55) off-center against a push rod (42) during the stroke of the actuating piston. The washer (55) cocks and grabs the push rod (42) and urges the rod forwardly within the tube holder (10). A drive piston (61) connected to the push rod is thereby driven forward within the tube holder for the full stroke of the actuating piston (61). When the trigger is released (110), the fluid in the actuating chamber is exhausted through a passage in the trigger piston, which thereby reduces the pressure in the actuating chamber. The reduced pressure in the chamber allows a spring (65) to uncock the washer (55) and bias the washer and the actuating piston (78) back into their initial positions, which provides for incremental movement of the push rod, and hence the drive piston.

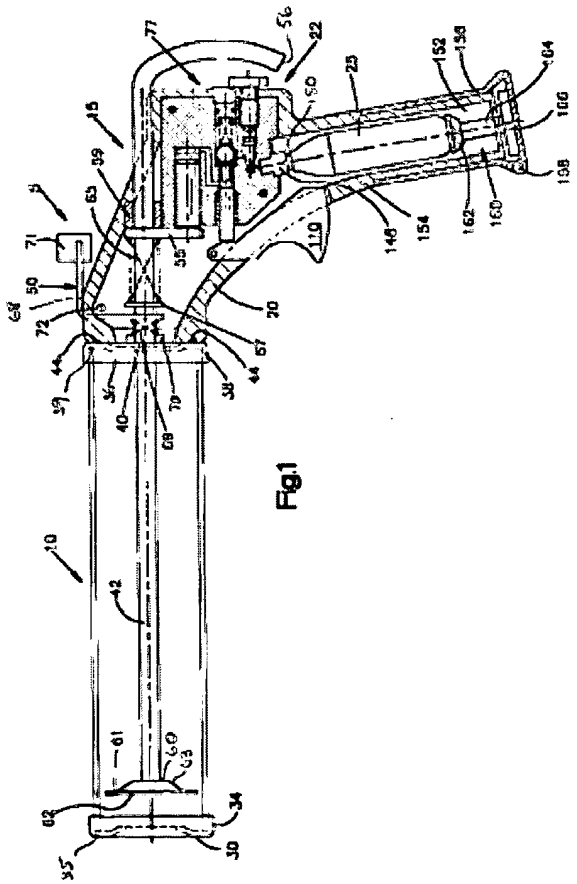

Fig1

Description

The present invention relates to a fluid operated dispensing device according to the preamble of claim 1 and to a method of dispensing a viscous product according to the preamble of claim 12.

Manually operated caulking guns have been designed for dispensing caulking compounds and other viscous or plastic material from disposable tubes. The caulking guns typically include a trigger mechanism which forces a drive piston on a push rod against a piston in the tube to dispense the selected quantity of caulking compound or other material.

One such manual caulking gun is manufactured by the COX Company under the tradename WEXFORD. The trigger mechanism in the COX gun includes a hand grip die-cast with a frame, and a trigger pivotally connected to the frame. The trigger is adapted to be pivoted towards the grip, which forces a flange on the trigger to drive a washer on a push rod off-center. The washer cocks and grabs the push rod, thereby urging the push rod forwardly within a tube holder. A drive piston connected to the push rod is thereby forced against the end of a tube in the tube holder to dispense the viscous or plastic material. At the end of the trigger stroke, the trigger is released, and a spring uncocks the washer and biases the washer and the trigger back into their initial position, while a locking lever prevents the push rod from moving rearwardly.

Conventional replaceable tubes for caulking compounds and other viscous or plastic material include a casing, a tube cap, and a plastic tube piston which together define a cavity for the material. The tube piston is adapted to be urged against the material and dispense the material through a nozzle over the cap. Tubes typically contain about 10 fluid oz. of material, but other sizes, such as 30 fluid oz., are available. The tubes are disposable and are designed to be replaced when exhausted, as compared to bulk caulking guns which have a dispensing chamber adapted to be filled directly with the viscous or plastic material. A typical replaceable tube designed for caulking compound is manufactured by The Glidden Company under the tradename MACCO Adhesives.

Other dispensers for caulking compounds or other material use compressed air instead of a manually applied force to dispense the material from the tube. The compressed air reduces the manual effort necessary to dispense the material. For example, U.S. Patent No. 3,983,947, discloses a caulking gun having a push rod in a chamber urged forwardly by compressed air entering the rear of the chamber. A trigger is adapted to urge a valve ball out of its seat within a valve chamber to allow the compressed air to flow around the valve ball and into the piston chamber.

Similarly, U.S. Patent No. 3,980,209, discloses a caulking gun for bulk dispensing of plastic or viscous material, wherein a piston in a forward barrel is connected by a shaft to a piston in a rear barrel. During dispensing of the material, a trigger is adapted to engage a trigger piston and allow compressed air to flow through an air passage to the rear of the forward barrel. The compressed air forces the forward piston against the material, which is thereby dispensed through a nozzle in the caulking gun.

Additionally, U.S. Patent No. 4,441,629, discloses a caulking gun wherein a CO_2 cartridge supplies compressed gas through a valve assembly to the rear portion of the caulking gun cylinder. The compressed gas is forced against the caulking tube piston, which thereby applies pressure to the caulking compound and dispenses the compound through the caulking tube nozzle.

These caulking guns however, are not without drawbacks. For example, when compressed air or gas is applied directly against the piston of the caulking tube, the piston has a tendency to tilt, and the compressed air or gas can leak around the piston and channel through the caulking compound. The channeling causes sputtering at the nozzle of the caulking tube and a degradation of the caulking product.

Moreover, compressed air from an air compressor is relatively inexpensive when compared to compressed gas from a CO_2 cartridge. Accordingly, caulking guns using compressed air from a compressor can more readily afford to exhaust a good portion of the air during use, such as through the movement of valves and leaks in the valve assembly.

However, using a dispensing device with the more portable, but relatively more expensive liquid CO_2 cartridge presents some important economic considerations. In particular, each CO_2 cartridge contains a limited amount of liquid CO_2. The gas which is produced from the liquid CO_2 must therefor be used as efficiently as possible for dispensing the viscous or plastic material.

In US Patent No. 3401847 (cf. preamble of claim 1 and of claim 12), there is disclosed a caulking gun having an externally mounted actuator piston the rod of which is connected via a mechanical linkage to a pawl located within the handle of the gun. Actuation of the piston causes cocking of the pawl into driving engagement with ratchet teeth formed in the drive rod of the gun.

According to a first aspect of the invention, there is provided a fluid operated dispensing de-

vice, comprising:

receiving means adapted to receive and dispense a viscous product;

a drive means disposed at least partially within the receiving means and adapted to urge the viscous product from the receiving means;

an actuating chamber;

an actuating piston adapted to reciprocate between an initial position and an extended position within said actuating chamber;

biasing means normally biasing said actuating piston to its initial position;

means for selectively supplying fluid to a portion of the actuating chamber to increase the pressure within the chamber and drive the actuating piston against its bias from its initial position to its extended position, and means to selectively exhaust said fluid from said portion of the actuating chamber to allow said actuating piston to return from its extended position to its initial position, whereby each activation of said actuating piston incrementally moves said drive means forward; and

locking means normally engaging said drive means to prevent movement of said drive means in the reverse direction, said locking means being disengageable from said drive means to allow manual movement of said drive means in the reverse direction, characterised in that said actuating piston is directly engageable with means surrounding said drive means for contacting and incrementally moving said drive means in a forward direction.

Thus, the present invention provides a new and useful dispensing device for dispensing a caulking compound or other viscous or plastic material. The dispensing device is designed to incrementally dispense the material from a disposable tube. The dispensing device includes a tube holder adapted to receive the tube, and a push rod having a drive piston adapted to engage the tube piston to dispense the viscous or plastic material.

The push rod is urged against the tube piston by an actuating piston. The actuating piston is adapted to engage a portion of a washer surrounding the push rod, and drive the washer off-center against the rod. The washer cocks and grabs the rod to force the rod, and hence the drive piston against the tube piston.

The actuating piston is disposed within an actuating chamber in a pressure regulating assembly. The pressure regulating assembly also includes a valve assembly having a trigger piston and a valve ball biased by a first spring and gas pressure into engagement with a valve seat.

A trigger is adapted to engage the trigger piston and urge the valve ball out of engagement with the valve seat, to thereby allow compressed gas to flow into the rear of the actuating chamber. The increase in gas pressure in the rear of the chamber drives the actuating piston from an initial position to an extended position in the chamber. The actuating piston drives the washer off-center against the push rod during the stroke of the actuating piston.

When the trigger is released, the valve ball is biased back into engagement with the valve seat by gas pressure and the first spring, and an exhaust passage is opened in the trigger piston. The gas in the actuating chamber flows out the exhaust passage and reduces the pressure in the actuating chamber. The reduced pressure in the actuating chamber allows a second spring to uncock the washer and bias the washer and the actuating piston back into their original positions.

In preferred embodiments of the invention, the dispensing device includes an actuating piston mounted co-axially with a push rod in an actuating chamber. Compressed air entering the rear of the actuating chamber increases the pressure in the chamber and forces the actuating piston forwardly to engage and move a drive washer. Releasing the trigger opens an exhaust passage connected to the front of the actuating chamber. The compressed air in the rear of the chamber flows out the exhaust passage and into the front of the chamber, which reduces the pressure in the rear of the chamber and allows the washer and the actuating piston to be biased back into their original positions.

Optionally, the dispensing device includes a pair of valve assemblies adapted to apply a variable load against the drive washer, depending on the viscosity of the product. The amount of load applied to the drive washer is selectable with a ramp switch.

One useful feature is that the compressed air or gas is not applied directly to the plastic tube piston. The compressed gas therefore cannot leak around the piston and channel through the viscous or plastic material to cause sputtering at the nozzle and degradation of the material. Moreover, the drive piston on the push rod keeps the tube piston from tilting in the tube during operation.

Another useful feature is that the exhaust passage in the trigger piston reduces the pressure within the actuating chamber after each stroke of the trigger. The reduced pressure in the chamber allows the actuating piston and drive washer to be biased back to their initial positions after each trigger pull. This feature allows incremental movement of the push rod against the tube piston to dispense the viscous or plastic material.

Moreover, another useful feature is that the structure of the valves and pistons within the dispensing device minimizes the amount of compressed gas necessary to dispense the plastic or viscous material, and reduces the amount of gas that is exhausted or leaked during dispensing. This feature accordingly improves the economic qualit-

slightly larger in diameter than the necked portion 92 of the trigger piston 80. The necked section 122 is designed to allow compressed gas to flow between the necked portion 92 of the trigger piston 80 and the inside walls of the necked section 122. The second passage 87 connects necked section 122 with the rear of the actuating chamber 79.

The necked section 122 of the valve chamber 84 widens to a second section, indicated generally at 124, and includes a second shoulder portion 126. An annular molded insert 128 is inserted within the second section 124 and traps an O-ring 130 between the inside edge of the insert 128 and the shoulder portion 126 of the second section 124. The edge (unnumbered) of the insert 128 includes a rubber ring 131 bonded thereto. The outside edge of the insert 128 and the ring 131 define a seat for the valve ball 81 to seal against, as discussed herein in more detail.

The second section 124 of the valve chamber 84 extends through the body 75, and includes the spring cup 88, the retaining plate 89 and the retaining ring 90. The spring cup 88 includes a recess (unnumbered) for an O-ring 134. The spring 83 is received within a cup-shaped portion 135 of the spring cup 88 and biases the valve ball 81 against the valve seat to fluidly seal the second section 124 of the valve chamber 84 from the necked section 122.

The first passage 85 is connected between the gas source 25 and the second section 124 of the valve chamber 84 at a point directly behind the seated valve ball 81. The compressed gas flowing into the second section 124 of the valve chamber 84 provides additional biasing of valve ball 81 into engagement with the valve seat.

A conventional flow control assembly can be included within the first passage 85, such as for example as shown generally at 136. The flow control assembly 136 includes an adjustment screw 138 and a regulator valve 140. The screw 138 is received within a threaded bore 142 and bears against the valve 140. The screw 138 is retained within the bore by retaining plate 89. The bore 142 includes a conical portion 144 which connects the first passage 85 with a short passage 145 to gas source 25.

The regulator valve 140 includes a tip 146 which includes elastomeric material bonded thereto and is adapted to be forced into the conical portion 144 of the bore 142 when the screw 138 is drawn down, as illustrated in Fig. 2. Consequently, when the valve 140 is closed, compressed gas is prevented from flowing from source 25 to the first passage 85. To allow gas to flow, the adjustment screw 138 is drawn up, as shown in Fig. 3, which draws the tip 146 away from the conical portion 144 and permits compressed gas to flow around the tip 146 and into the first passage 85.

The short passage 145 from the bore 142 is connected to a cartridge adapter 148. The adapter 148 is adapted to puncture and seal against the nozzle 150 of a conventional gas source 25, such as a CO_2 cartridge. As shown in Fig. 1, the CO_2 cartridge is contained in a cavity 152 formed in a handle portion 154 of the housing 20. The handle portion 154 includes a cover 156 which is hinged at 158, and which may be opened to provide access to the cartridge.

The cartridge 25 is secured between the adapter 148 and a holder assembly, indicated generally at 160. The holder assembly 160 includes a cup 162 which engages the bottom portion of the cartridge 25, and a hold down screw 164. The hold down screw 164 is tightened down through a jam nut 166 attached to handle portion 154, so that the cup 162 engages the bottom of the cartridge 25 and forces the cartridge to seal against the adapter 148. A hollow needle (not shown) in the adapter 148 pierces the seal on the cartridge nozzle 150 and allows compressed gas to flow from the cartridge into the valve assembly 76.

To remove the cartridge 25, the hinged cover 156 is opened and the hold down screw 164 is untightened, which releases the pressure of the cup 162 against the cartridge bottom, and allows removal of an exhausted cartridge. A fresh cartridge is inserted within the cavity 152 and the cup 162 is again tightened against the cartridge to force the cartridge nozzle 150 into the adapter.

The CO_2 cartridge is conventional in design and is manufactured by a variety of companies, including Crossman Air Guns. The cartridge is disposable and is adapted to be removed and replaced when exhausted. Cartridges having other suitable propellants besides CO_2 can also be used with the present invention.

The operation of the dispensing device 5 is as follows. When the trigger 110 is depressed, the trigger piston 80 is urged against the valve ball 81 and the exhaust passage 98 is sealed against the ball 81, as shown in Fig. 3. The valve ball 81 is moved away from the valve seat, and compressed gas flows at saturated pressure from the CO_2 cartridge through an open valve 136 and the first passage 85 to the second section 124 of valve chamber 84. The gas flows around the valve ball 81 and the necked portion 92 of the trigger piston 80 to the second passage 87. The gas flows through the second passage 87 and into the rear portion of the actuating chamber 79.

The actuating chamber 79 comprises a longitudinally extending bore formed in body 75, and is adapted to slidingly receive the actuating piston 78 therein. The actuating piston 78 includes a tapered rear end 168, and a forward end 170 having a

driving surface 171. A conventional O-ring 172 is received within a circumferential groove (not numbered) formed in the actuating piston 78 to prevent compressed gas from escaping around the piston.

The compressed gas flowing through the second passage 87 enters the rear of the actuating chamber 79 and surrounds the tapered portion 168 of the actuating piston 78. The pressure within the rear of the chamber 79 increases, which forces the piston 78 outwardly from the chamber 79. The forward, driving surface 171 of the piston 78 engages an off-center portion of the drive washer 55. The drive washer 55 thereby cocks and grabs the push rod 42.

As the actuating piston 78 moves outwardly from the actuating chamber 79, the push rod 42 is thereby moved forwardly within the tube holder 10 (Fig. 1) during the stroke of the piston 78. The drive piston 61 (Fig. 1) connected to the push rod 42 is thereby forced against a caulking tube piston to dispense the caulking product. The actuating piston 78 continues to advance from the actuating chamber 79 into an extended position until the spring 65 is compressed and prevents further forward movement.

Accordingly, the movement of the push rod 42, and hence the drive piston 61, in the dispensing device is limited to the stroke of the actuating piston 78. The movement of the push rod 42 is therefore only a small increment of its total possible movement.

When the drive washer 55 reaches the end of the stroke, the pressure within the actuating chamber 79, the first passage 85, the second passage 87, and the valve assembly 84 is essentially in equilibrium. When the trigger 110 is released, as shown in Fig. 2, the spring 83 in the valve assembly 84, and the pressure of gas from the gas source 25 bias the valve ball 81 and trigger piston 80 back into their original positions. The valve ball 81 is thereby urged into engagement with the valve seat to seal the second section 124 of the valve chamber 84 from the first section 99 and prevent further compressed gas from entering the actuating chamber 79.

After the trigger 110 is released, the gas pressure in the necked section 122 moves the trigger piston 80 out of engagement with the valve ball 81, which thereby opens the exhaust passage 98. The trigger piston 80 urges the trigger 110 towards its initial position until edge 172 of trigger 110 engages side 174 of aperture 113.

The gas contained in the actuating chamber 79, as well as the small amount of gas in the second passage 87, flows out through the exhaust passage 98, thereby reducing the pressure in the actuating chamber 79. The reduced pressure in the actuating chamber 79 allows the actuating piston 78 and the drive washer 55 to be biased by spring 65 back into their initial positions for the next trigger actuation.

The drive assembly 15, pressure regulating assembly 22, and gas source 25 thereby provide incremental movement of the drive piston 61 (Fig 1) against the tube piston to dispense the caulking compound or other viscous or plastic material. The amount of compressed gas needed for this process is determined by the short stroke of the actuating piston 78 and the small volume of the passages. Moreover, the amount of exhausted or leaked CO_2 is minimized.

A subsequent actuation of the trigger 110 will cause another incremental movement of the push rod 42. Release of the trigger 110 will again allow biasing of the actuating piston 78 and drive washer back 55 into their original positions. Hence, each incremental movement of the push rod 42 will be accomplished by a single stroke of the actuating piston 78. Each full stroke requires the same amount of compressed gas, irrespective of the location of the drive washer 55 along the push rod 42.

In a second embodiment of the invention, as shown in Fig. 4, the dispensing device includes an actuating piston 200 mounted coaxially with a push rod 202. In this embodiment, an air hose (not shown) can be used to supply compressed air to the dispensing device from a conventional air compressor. Alternatively, a rolling diaphragm (not shown) can be used in place of the sliding actuating piston 200.

In the second embodiment, the tube holder 10, the drive assembly 15, and the locking assembly 50 are substantially the same as in the first embodiment, and hence the same reference numbers will apply. Further, the tube holder 10 includes a second end piece 36 which is attached by spot welds 44 to a housing 203. The housing 203 at least partially encloses the drive assembly 15, a pressure regulating assembly, indicated generally at 204, and tubing 206.

The pressure regulating assembly 204 includes a valve chamber, indicated generally at 208, formed in a body 209. The valve body 209 is formed from aluminum or other appropriate material. The chamber 208 is adapted to receive a valve 212 and a spring 214. As shown in Fig. 7, trigger 215 is adapted to urge the valve 212 away from a valve seat 249 and into sealing engagement with seat 250. This allows compressed air to flow from tubing 206 through a first air passage 216, and into the rear of an actuating chamber 220. The increase in pressure in the actuating chamber 220 forces the actuating piston 200 forwardly against the drive washer 55 to dispense the caulking compound or other viscous or plastic material.

To this end, the air hose from a conventional air compressor is removably connected to the tubing 206 through a conventional connector assembly 222 in a handle portion 224 of the housing 203. The tubing 206 extends to a short passage 225, which is connected to the pressure regulating assembly 204 and supplies the assembly with compressed air.

Referring again to Fig. 4, the valve 212 is formed from a one-piece aluminum design and includes a valve ball 226, a connecting rod 228 and a piston head 230. The piston head 230 includes a circumferentially formed groove (not numbered) which is designed to receive an O-ring 232 therein. The valve 212 extends through an aperture (not numbered) formed in a first molded plastic insert 234. The O-ring 232 engages the inside of the first molded insert 234 in the valve chamber 208 to prevent air from escaping through the valve chamber. The molded insert 234 is retained within valve chamber 208 by a retaining ring 235. Additional O-rings 236 are also provided between the molded insert 234 and the valve chamber 208.

The valve 212 further extends through an aperture (not numbered) formed in a second molded plastic insert 240 in the valve chamber 208. An O-ring 241 is provided in a recess (unnumbered) in the second molded insert 240. The first molded insert 234 includes a spacer (not shown) which separates insert 134 from the second molded insert 240 and forms a bore 242 therebetween. Bore 242 is connected by passage 225 to tubing 206.

The second molded insert 240 is received towards the inner end 245 of the valve chamber 208. The second insert 240 includes an axially extending bore 246 formed therein. The bore 246 at least partially receives the spring 214. The second insert 240 includes a recess (not numbered) designed to receive an O-ring 247 therein.

The second insert 240 further includes a laterally extending exhaust bore 248. The end 249 of the aperture in the second insert 240 forms a first valve seat for the valve head 226, while the open end 250 of bore 246 forms a second valve seat for the valve head 226. The bore 248 is connected by the first passage 216 (Fig. 7) to the rear of the actuating chamber 220.

The second insert 240 further includes a laterally extending bore 252. The bore 252 extends at least partially into the axial bore 246. The bore 252 is connected by a second passage 253 to the forward portion 254 of the actuating chamber 220.

The valve 212 is located in the valve chamber 208 such that the valve ball 226 can axially reciprocate within the lateral bore 248. The valve head 230 and the connecting rod 228 are slidingly received within the first insert 234. The valve ball 226 is adapted to reciprocate between the first valve seat 249 and the second valve seat 250 and seal to a respective seat. The spring 214 extends partially out of bore 246 and normally biases the valve ball 226 forwardly into engagement with the first valve seat 249.

When compressed air is initially applied to the valve chamber 208 through the tubing 206, the air flows through the bore 242 and around the connecting rod 228. Specifically, the compressed air is applied simultaneously against both the piston head 230 and the valve ball 226. Accordingly, the valve ball 226 is not initially urged out of its spring biased, sealing engagement with the first valve seat 249.

As shown in Fig. 7, the trigger 215 is adapted to engage the piston head 230 of valve 212, and urge the valve ball 226 away from its initial engagement with the first valve seat 249 and into sealing engagement with the second valve seat 250. The compressed air can thereby pass around the connecting rod 228 and valve ball 226, up through passage 216, and into the rear of the actuating chamber 220.

The first air passage 216 extends from the valve chamber 208 to the actuating chamber 220 and, along with the second air passage 253 (Fig. 4), is formed in two parts. In particular, as shown in Figs. 5 and 6, the first vertically extending portion 216a of the first air passage 216 (Fig. 7) and the horizontally extending portion 216b are formed in the body 209. The second vertically extending portion 216c, however, is formed in a cylinder body 260. The cylinder body 260 is adapted to be attached and sealed to the body 209 with bolts 261 (Fig. 6) and sealing rings (not shown) to provide the whole passage 216.

Similarly, the second air passage 253 has a first vertical portion 253a, and a horizontally extending portion 253b formed in the body 209. A second vertical portion 253c is formed in the body 260.

Referring again to Fig. 7, the cross sectional area of cylinder body 260 forms a C-shaped shell 262. The shell 262 includes an aperture 263 adapted to allow relative movement of the push rod 202 and the actuating piston 200. The chamber 220 further includes a forward plate 264 secured between the open ends of the C-shaped shell 262. The forward plate 264 includes an exhaust opening 265 formed therein. An O-ring 266 is located within a recess (unnumbered) in the actuating piston to prevent the compressed air from leaking between the aperture 263 in the shell 262 and the actuating piston 200.

As the compressed air enters the rear of chamber 220, the pressure increases within the chamber. The increased pressure urges the piston 200 forwardly within the actuating chamber 220. Air

(Fig. 10).

The first passage 344 includes an extension 376 that connects the passage 344 with the second valve assembly 320 and taps off a portion of the compressed gas flowing therein. The extension passage 376 is connected to the second valve assembly 320 at a point rearwardly from the seated valve ball 366. As with the first valve assembly 310, the compressed gas received through the extension 376 of the second passage 344 cooperates with the spring 368 to initially bias the valve ball 366 into a sealing relationship with the valve seat.

When the valve ball 366 is dislodged from its seat by the trigger piston 364, as shown in Fig. 10, compressed gas flows through the extension 376 in the first passage 344, around the valve ball 366, around the necked portion 372, and into the short second passage 358. The compressed gas enters the second passage 358 and flows through bore 356 to bear against the actuating piston 322.

The trigger piston 364 in the second valve assembly 320 is urged into engagement with the valve ball 366 by a slide or ramp switch 380 located on the housing 382. The switch 380 is slidingly attached to the housing 382 and has a ramped portion 384 which is adapted to engage the end 385 of the trigger piston 364 and drive the piston 364 into sealing engagement with the valve ball 366. The compressed gas enters the bore 356 within the shaft 350 and increases the pressure against the actuating piston 322, thereby forcing the piston outwardly from the actuating chamber 324 and against the drive washer 55.

For a low viscosity caulking compound, the first valve assembly 310 can be used independently of the second valve assembly 320 to provide adequate dispensing characteristics for the dispensing device. In this case, the second valve assembly 320 can remain inoperative by moving the switch 380 away from engagement with the drive piston, as shown in Figs. 8 and 9. In this manner, the bore 356 of shaft 350 is fluidly connected to the exhaust passage 374 in the trigger piston 364 to maintain an ambient pressure in the bore 356 during the movement of the actuating piston 322. Using the single valve assembly 310 reduces the amount of compressed gas necessary to dispense the low viscosity product from the dispensing device.

However, when a higher viscosity material is being dispensed, the first and second valve assemblies 310, 320 can be used simultaneously. In this case, the switch 380 can be driven against the trigger piston 364 to force the valve ball 366 from the valve seat and allow compressed gas to flow into the bore 356 within shaft 350, as shown in Fig. 10. The second valve assembly 320 provides additional compressed gas to the actuating piston 322. The extra piston area that the gas is being applied to will provide for increased force against the drive washer 55 and proper dispensing of the highly viscous product.

Accordingly, the foregoing embodiments describe a dispensing device which provides for dispensing caulking compounds or other viscous or plastic material in a manner which anticipates the economic considerations consonant with using liquified gas. Additionally, this device increases the effectiveness of a dispensing device by eliminating sputtering at the nozzle and tilting of the tube piston caused by compressed gas or air being applied directly to the tube piston. Moreover, the device provides for incremental movement of the drive piston against the tube piston for dispensing of the material.

The principles, preferred embodiments and modes of operation of the present invention have been described in the foregoing specification. The invention which is intended to be protected herein should not, however, be construed as limited to the particular form described as it is to be regarded as illustrative rather than restrictive.

For example, a larger tube, such as a 30 oz. caulking tube, can be used with the dispensing device. The relative size of the pistons, valves and drive washer can be increased in such a case to compensate for the additional force required to drive the tube piston within the caulking tube. Accordingly, the foregoing detailed description is to be regarded as exemplary in nature.

Claims

1. A fluid operated dispensing device (5), comprising:

receiving means (10) adapted to receive and dispense a viscous product;

a drive means (15) disposed at least partially within the receiving means (10) and adapted to urge the viscous product from the receiving means;

an actuating chamber (79;220;324);

an actuating piston (78;200;322) adapted to reciprocate between an initial position and an extended position within said actuating chamber;

biasing means (65) normally biasing said actuating piston (78;200;322) to its initial position;

means (22;204;300) for selectively supplying fluid to a portion of the actuating chamber to increase the pressure within the chamber and drive the actuating piston (78;200;322) against its bias from its initial position to its extended position, and means (98;252,253,265;374) to selectively exhaust said fluid from said portion of the actuating

chamber to allow said actuating piston to return from its extended position to its initial position, whereby each activation of said actuating piston incrementally moves said drive means forward; and

locking means (71,72) normally engaging said drive means to prevent movement of said drive means in the reverse direction, said locking means being disengageable from said drive means to allow manual movement of said drive means in the reverse direction, characterised in that said actuating piston is directly engageable with means (55) surrounding said drive means for contacting and incrementally moving said drive means in a forward direction.

2. A dispensing device as in Claim 1, wherein said drive means (15) comprises a drive piston (61) and a push rod (42;202;309), said actuating piston being engageable with a washer (55) located around said push rod (42;202;309) in an initial position and adapted to be driven off-centre and against said push rod into an extended position by said actuating piston (78;200;322).

3. A dispensing device as in Claim 2, wherein said biasing means includes a spring (65), said spring being located around said push rod in contact with said washer (55) and adapted to bias said washer (55) and said actuating piston (78;200;322) into said initial positions.

4. A dispensing device as in Claim 1, wherein said means for selectively supplying fluid comprises a valve assembly (77), said valve assembly selectively supplying fluid from a fluid source (25) to the portion of said actuating chamber.

5. A dispensing device as in Claim 4, wherein said valve assembly (77) includes a trigger piston (80) and a valve ball (81) located within a valve chamber (84) and biased by a spring (88), said trigger piston (80) being actuatable by a trigger (110) to engage said valve ball (81) and allow fluid to flow from said fluid source (25) to the portion of the actuating chamber, said trigger piston (80) having an exhaust passage (98) extending axially therethrough to selectively exhaust fluid from said actuating chamber when the trigger (110) is released.

6. A dispensing device as in Claim 4, wherein said means for selectively supplying fluid includes a replaceable CO_2 cartridge (25), said replaceable CO_2 cartridge (25) providing fluid to said portion of the actuating chamber.

7. A dispensing device according to Claim 4 or Claim 5, characterised in that the valve assembly has a second piston (364) and a valve ball (366) disposed within a valve chamber, said second piston including an exhaust passage (370) formed therein, said exhaust passage being adapted to allow fluid to exhaust from the dispensing device to allow said actuating piston to return from its extended position to its initial position.

8. A dispensing device according to any preceding claim, characterised in that said means for selectively supplying fluid comprises first (310) and second (320) valve assemblies, each of said first and second valve assemblies including valves (327,330,372,366) to selectively supply fluid to the actuating chamber.

9. A device according to Claim 8, characterised in that the second valve assembly has a third piston and a second valve ball disposed within a second valve chamber.

10. A dispensing device according to Claim 9, further characterised in that the actuating chamber includes two separate portions, one (310) of said pair (310,320) of valve assemblies being adapted to selectively provide fluid to one of said two separate portions of said actuating chamber, and the other (320) of said pair of valve assemblies being adapted to selectively provide fluid to the other of said two separate portions of said actuating chamber.

11. A dispensing device as in Claim 1, wherein said drive means includes a drive rod (202), said drive rod extending through at least a portion of said actuating chamber (220) and being at least partially surrounded by and moveable relative to said actuating piston (200).

12. A method of dispensing a viscous product from a dispensing device (5), comprising:

providing a receiving and dispensing means (10) in the dispensing device (5) with a viscous product,

biasing an actuating piston (78;200;322) and a washer (55) into an initial position;

applying fluid to a portion of an actuating chamber (79;220;324) to increase the pressure within the chamber and force the actuating piston (78;200;322) against its bias from the initial position to an extended position;

incrementally moving the washer (55) off-centre such that said off-centre washer grabs and moves a push rod (40;202;309);

moving a drive piston (61) connected to the push rod (40;202;309) within said receiving and dispensing means (10) to bear against the viscous product, and

dispensing the viscous product from the dispensing device (5), characterised in that the step of moving the washer (55) into an initial position results in the washer surrounding the push rod; and the step of moving the washer (55) off-centre includes the step of directly engaging the washer with the actuating piston.

13. A method of dispensing a viscous product from a dispensing device (5) as in claim 10, wherein said step of applying fluid to a portion of an actuating chamber further comprises selectively applying fluid through at least one of a pair of valve assemblies (310;320) to a portion of the actuating chamber to force the actuating piston from the initial position to the extended position, each of said pair of valve assemblies being capable of applying fluid to a separate portion of the actuating chamber.

Patentansprüche

1. Fluidbetätigte Ausgabevorrichtung (5) mit:
Aufnahmemitteln (10), die geeignet ausgestaltet sind, um ein viskoses Produkt aufzunehmen und zu entleeren;
einem Antriebsmittel (15), welches mindestens teilweise innerhalb der Aufnahmemittel (10) angeordnet und geeignet derart ausgestaltet ist, daß es das viskose Produkt aus dem Aufnahmemittel drückt;
einer Betätigungskammer (79;220,324);
einem Betätigungskolben (78;200;322), der geeignet ausgestaltet ist, um sich zwischen einer anfänglichen Position und einer ausgefahrenen Position innerhalb der Betätigungskammer hin- und herzubewegen;
Vorspannmitteln (65), die normalerweise den Betätigungskolben (78; 200; 322) in seine anfängliche Position vorspannen;
Mitteln (22;204;300) für das selektive Zuführen von Fluid zu einem Teil der Betätigungskammer, um den Druck in der Betätigungskammer zu erhöhen und den Betätigungskolben (78;200;322) gegen seine Vorspannung aus seiner anfänglichen Position in seine ausgefahrene Position zu treiben, und Mitteln (98;252,253,265;374), um selektiv das Fluid aus dem Teil der Betätigungskammer zu entleeren, um es dem Betätigungskolben zu ermöglichen, aus seiner ausgefahrenen Position in seine anfängliche Position zurückzukehren, wobei jede Betätigung des Betätigungskolbens das Antriebsmittel inkrementell vorbewegt; und
Sperrmitteln (71,72), welche normalerweise mit dem Antriebsmittel in Eingriff stehen, um die Bewegung des Antriebsmittels in der umgekehrten Richtung zu verhindern, wobei das Sperrmittel von dem Antriebsmittel außer Eingriff bringbar ist, um eine Handbewegung des Antriebsmittels in der umgekehrten Richtung zu ermöglichen, dadurch gekennzeichnet, daß der Betätigungskolben direkt mit Mitteln (55) in Eingriff bringbar ist, welche das Antriebsmittel für das Berühren und inkrementelle Bewegen des Antriebsmittels in einer Vorwärtsrichtung zu umfassen.

2. Ausgabevorrichtung nach Anspruch 1, wobei das Antriebsmittel (15) einen Antriebskolben (61) und eine Stößelstange (42;202,309) aufweist, wobei der Betätigungskolben mit einer Scheibe (55) in Eingriff bringbar ist, welche um die Stößelstange (42;202,309) in einer anfänglichen Position angeordnet und geeignet ausgebildet ist, um außermittig und gegen die Stößelstange in eine ausgefahrene Position von dem Betätigungskolben (78; 200; 322) getrieben zu werden.

3. Ausgabevorrichtung nach Anspruch 2, wobei das Vorspannmittel eine Feder (65) aufweist, die um die Stößelstange herum in Kontakt mit der Scheibe (55) angeordnet und geeignet ausgestaltet ist, um die Scheibe (55) und den Betätigungskolben (78;200;322) in seine anfänglichen Positionen vorzuspannen.

4. Ausgabevorrichtung nach Anspruch 1, wobei das Mittel zum selektiven Zuführen von Fluid eine Ventilanordnung (77) aufweist, die selektiv Fluid aus einer Fluidquelle (25) zu dem Teil der Betätigungskammer zuführt.

5. Ausgabevorrichtung nach Anspruch 4, wobei die Ventilanordnung (77) einen Auslösekolben (80) und eine Ventilkugel (81) aufweist, welche innerhalb einer Ventilkammer (84) angeordnet und durch eine Feder (88) vorgespannt ist, wobei der Auslösekolben (80) durch einen Auslöser (110) betätigbar ist, um mit der Ventilkugel (81) in Eingriff zu kommen und es dem Fluid zu erlauben, aus der Fluidquelle (25) zu dem Teil der Betätigungskammer zu fließen, wobei der Auslösekolben (80) einen Entleerungsdurchgang (98) hat, der sich axial durch den Kolben erstreckt, um selektiv Fluid aus der Betätigungskammer zu entleeren, wenn der Auslöser (110) losgelassen wird.

6. Ausgabevorrichtung nach Anspruch 4, wobei das Mittel zum selektiven Zuführen von Fluid eine ersetzbare CO_2-Kassette (25) aufweist, die Fluid zu dem Teil der Betätigungskammer schafft.

7. Ausgabevorrichtung nach Anspruch 4 oder Anspruch 5, dadurch gekennzeichnet, daß die Ventilanordnung einen zweiten Kolben (364) und eine Ventilkugel (366) hat, die in einer Ventilkammer angeordnet ist, wobei derzweite Kolben einen darin gebildeten Entleerungsdurchgang (370) aufweist und der Entleerungsdurchgang geeignet ausgestaltet ist, um dem Fluid die Möglichkeit zu geben, aus der Ausgabevorrichtung entleert zu werden, um es dem Betätigungskolben zu erlauben, aus seiner ausgefahrenen Position in seine anfängliche Position zurückzukehren.

8. Ausgabevorrichtung nach einem vorhergehenden Anspruch, dadurch gekennzeichnet, daß das Mittel zum selektiven Zuführen von Fluid erste (310) und zweite (320) Ventilanordnungen aufweist, deren jede Ventile (327,330,372,366) aufweist, um selektiv Fluid zu der Betätigungskammer zuzuführen.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß die zweite Ventilanordnung einen dritten Kolben und eine zweite Ventilkugel hat, die innerhalb einer zweiten Ventilkammer angeordnet ist.

10. Ausgabevorrichtung nach Anspruch 9, ferner dadurch gekennzeichnet, daß die Betätigungskammer zwei separate Teile aufweist, wobei einer (310) des Paares (310,320) von Ventilanordnungen geeignet ausgestaltet ist, um selektiv Fluid zu einem der zwei separaten Teile der Betätigungskammer zu schaffen, und der andere (320) des Paares von Ventilanordnungen geeignet ist, um selektiv Fluid zu dem anderen der zwei separaten Teile der Betätigungskammer zu schaffen.

11. Ausgabevorrichtung nach Anspruch 1, wobei das Antriebsmittel eine Antriebsstange (202) aufweist, die sich durch mindestens einen Teil der Betätigungskammer (220) erstreckt und mindestens teilweise von dem Betätigungskolben (200) umgeben wird und relativ zu diesem bewegbar ist.

12. Verfahren zum Abgeben eines viskosen Produktes aus einer Ausgabevorrichtung (5), mit:
Vorsehen eines Aufnahme- und Ausgabemittels (10) in der Ausgabevorrichtung (5) mit einem viskosen Produkt,
Vorspannen eines Betätigungskolbens (78;200;322) und einer Scheibe (55) in eine Anfangsposition;
Aufbringen von Fluid zu einem Teil einer Betätigungskammer (79;220;324), um den Druck in der Kammer zu erhöhen und den Betätigungskolben (78;200;322) gegen seine Vorspannung aus der anfänglichen Position in eine ausgefahrene Position zu drücken;
inkrementellem Bewegen der Scheibe (55) exzentrisch derart, daß die exzentrische Scheibe eine Stößelstange (40;202;309) greift und bewegt;
Bewegen eines Antriebskolbens (61), der mit der Stößelstange (40; 202; 309) in dem Aufnahme- und Ausgabemittel (10) verbunden ist, um eine Abstützung gegen das viskose Produkt vorzusehen, und
Ausgeben des viskosen Produktes aus der Ausgabevorrichtung (5), dadurch gekennzeichnet, daß der Schritt des Bewegens der Scheibe (55) in eine Anfangsposition dazu führt, daß die Scheibe die Stößelstange umgibt; und der Schritt des außermittigen Bewegens der Scheibe (55) den Schritt des direkten Eingriffes der Scheibe mit dem Betätigungskolben einschließt.

13. Verfahren zum Ausgeben eines viskosen Produktes aus einer Ausgabevorrichtung (5) nach Anspruch 10, wobei der Schritt des Aufbringens von Fluid zu einem Teil einer Betätigungskammer ferner das selektive Aufbringen von Fluid durch mindestens eine von zwei Ventilanordnungen (310;320) zu einem Teil der Betätigungskammer aufweist, um den Betätigungskolben aus der anfänglichen Position in die ausgefahrene Position zu zwingen, wobei jede der zwei Ventilanordnungen in der Lage ist, Fluid zu einem separaten Teil der Betätigungskammer aufzubringen.

Revendications

1. Distributeur actionné par fluide (5), comprenant :

un moyen récepteur (10) adapté à recevoir et distribuer un produit visqueux;

un moyen d'entraînement (15) disposé au moins partiellement au sein du moyen récepteur (10) et adapté à solliciter le produit visqueux depuis le moyen récepteur;

une chambre d'actionnement (79;220;324);

un piston d'actionnement (78;200;322) adapté à aller et venir entre une position initiale et une position étendue au sein de ladite chambre d'actionnement;

un moyen de sollicitation (65) sollicitant normalement ledit piston d'actionnement (78;200;322) jusqu'à sa position initiale;

un moyen (22;204;300) pour distribuer sélectivement un fluide jusqu'à une portion de la chambre d'actionnement afin d'augmenter la pression au sein de la chambre et d'entraîner le piston d'actionnement (78;200;322) à l'encontre de sa sollicitation de sa position initiale à sa position étendue, et un moyen (98;252,253,265; 374) pour expulser sélectivement ledit fluide de ladite portion de la chambre d'actionnement afin de permettre audit piston d'actionnement de retourner de sa position étendue à sa position initiale, de sorte que chaque actionnement dudit piston d'actionnement déplace de manière incrémentielle ledit moyen d'entraînement vers l'avant; et

un moyen de verrouillage (71, 72) engageant normalement ledit moyen d'entraînement pour empêcher le déplacement dudit moyen d'entraînement dans la direction inverse, ledit moyen de verrouillage pouvant être dégagé dudit moyen d'entraînement pour permettre un déplacement manuel dudit moyen d'entraînement dans la direction inverse, caractérisé en ce que ledit piston d'actionnement peut être engagé directement avec un moyen (55) entourant ledit moyen d'entraînement pour contacter et déplacer de manière incrémentielle ledit moyen d'entraînement dans une direction avant.

2. Distributeur selon la revendication 1, dans lequel ledit moyen d'entraînement (15) comprend un piston d'entraînement (61) et un poussoir (42;202;309), ledit piston d'actionnement pouvant être engagé avec une rondelle (55) située autour dudit poussoir (42; 202;309) dans une position initiale et adaptée à être entraînée par décentrage et à l'encontre dudit poussoir dans une position étendue par ledit piston d'actionnement (78;200;322).

3. Distributeur selon la revendication 2, dans lequel ledit moyen de sollicitation comprend un ressort (65), ledit ressort étant situé autour dudit poussoir en contact avec ladite rondelle (55) et adapté à solliciter ladite rondelle (55) et ledit piston d'actionnement (78;200;322) dans lesdites positions initiales.

4. Distributeur selon la revendication 1, dans lequel ledit moyen pour distribuer sélectivement un fluide comprend un ensemble de soupape (77), ledit ensemble de soupape distribuant sélectivement le fluide d'une source de fluide (25) à la portion de ladite chambre d'actionnement.

5. Distributeur selon la revendication 4, dans lequel ledit ensemble de soupape (77) comprend un piston déclencheur (80) et une bille de soupape (81) situés au sein d'une chambre de soupape (84) et sollicités par un ressort (83), ledit piston déclencheur (80) pouvant être actionné par une détente (110) pour engager ladite bille de soupape (81) et permettre au fluide de s'écouler de ladite source de fluide (25) à la portion de la chambre d'actionnement, ledit piston déclencheur (80) comportant un passage d'échappement (98) s'étendant axialement en son sein pour expulser sélectivement le fluide de ladite chambre d'actionnement lorsque la détente (110) est relâchée.

6. Distributeur selon la revendication 4, dans lequel ledit moyen pour distribuer sélectivement le fluide comprend une cartouche de CO_2 remplaçable (25), ladite cartouche de CO_2 remplaçable (25) distribuant le fluide à ladite portion de la chambre d'actionnement.

7. Distributeur selon la revendication 4 ou 5, caractérisé en ce que l'ensemble de soupape comporte un deuxième piston (364) et une bille de soupape (366) disposés au sein d'une chambre de soupape, ledit deuxième piston comprenant un passage d'échappement (370) formé en son sein, ledit passage d'échappement étant adapté à permettre au fluide de sortir du distributeur pour permettre audit piston d'actionnement de retourner de sa position étendue à sa position initiale.

8. Distributeur selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit moyen pour distribuer sélectivement le fluide comprend un premier (310) et un second (320) ensembles de soupape, chacun desdits premier et second ensembles de soupape comprenant des soupapes (327, 330, 372, 366) pour distribuer sélectivement le fluide à la chambre d'actionnement.

9. Distributeur selon la revendication 8, caractérisé en ce que le second ensemble de soupape comporte un troisième piston et une seconde bille de soupape disposés au sein d'une seconde chambre de soupape.

10. Distributeur selon la revendication 9, caractérisé en outre en ce que la chambre d'actionnement comprend deux portions distinctes, un ensemble de soupape (310) de ladite paire (310,320) d'ensembles de soupape étant adap-

té à distribuer sélectivement le fluide à l'une desdites deux portions distinctes de ladite chambre d'actionnement, et l'autre ensemble de soupape (320) de ladite paire d'ensembles de soupape étant adapté à distribuer sélectivement le fluide à l'autre desdites deux portions distinctes de ladite chambre d'actionnement.

11. Distributeur selon la revendication 1, dans lequel ledit moyen d'entraînement comprend une tige d'entraînement (202), ladite tige d'entraînement s'étendant à travers au moins une porton de ladite chambre d'actionnement (220) et étant au moins partiellement entourée par ledit piston d'actionnement (200) et mobile relativement à celui-ci.

12. Procédé de distribution d'un produit visqueux depuis un distributeur (5), comprenant les phases consistant à :

doter un moyen récepteur et distributeur (10) dans le distributeur (5) d'un produit visqueux,

solliciter un piston d'actionnement (78;200;322) et une rondelle (55) dans une position initiale;

appliquer un fluide sur une portion d'une chambre d'actionnement (79;220;324) pour augmenter la pression au sein de la chambre et amener de force le piston d'actionnement (78;200;322) à l'encontre de sa sollicitation de la position initiale à une position étendue;

déplacer de manière incrémentielle la rondelle (55) en la décentrant de manière que ladite rondelle décentrée saisisse et déplace un poussoir (42;202;309);

déplacer un piston d'entraînement (61) relié au poussoir (42; 202;309) au sein dudit moyen récepteur et distributeur (10) pour qu'il porte contre le produit visqueux, et

distribuer le produit visqueux depuis le distributeur (5), caractérisé en ce que la phase de déplacement de la rondelle (55) dans une position initiale a pour effet que la rondelle entoure le poussoir; et la phase de déplacement de la rondelle (55) en la décentrant comprend l'opération consistant à engager directement la rondelle avec le piston d'actionnement.

13. Procédé de distribution d'un produit visqueux depuis un distributeur (5) selon la revendication 10, dans lequel ladite phase d'application de fluide sur une portion d'une chambre d'actionnement comprend en outre l'opération consistant à appliquer sélectivement le fluide via au moins un ensemble de soupape d'une paire d'ensembles de soupape (310;320) sur une portion de la chambre d'actionnement afin d'amener de force le piston d'actionnement de la position initiale à la position étendue, chaque ensemble de soupape de ladite paire d'ensembles de soupape étant capable d'appliquer le fluide sur une portion distincte de la chambre d'actionnement.

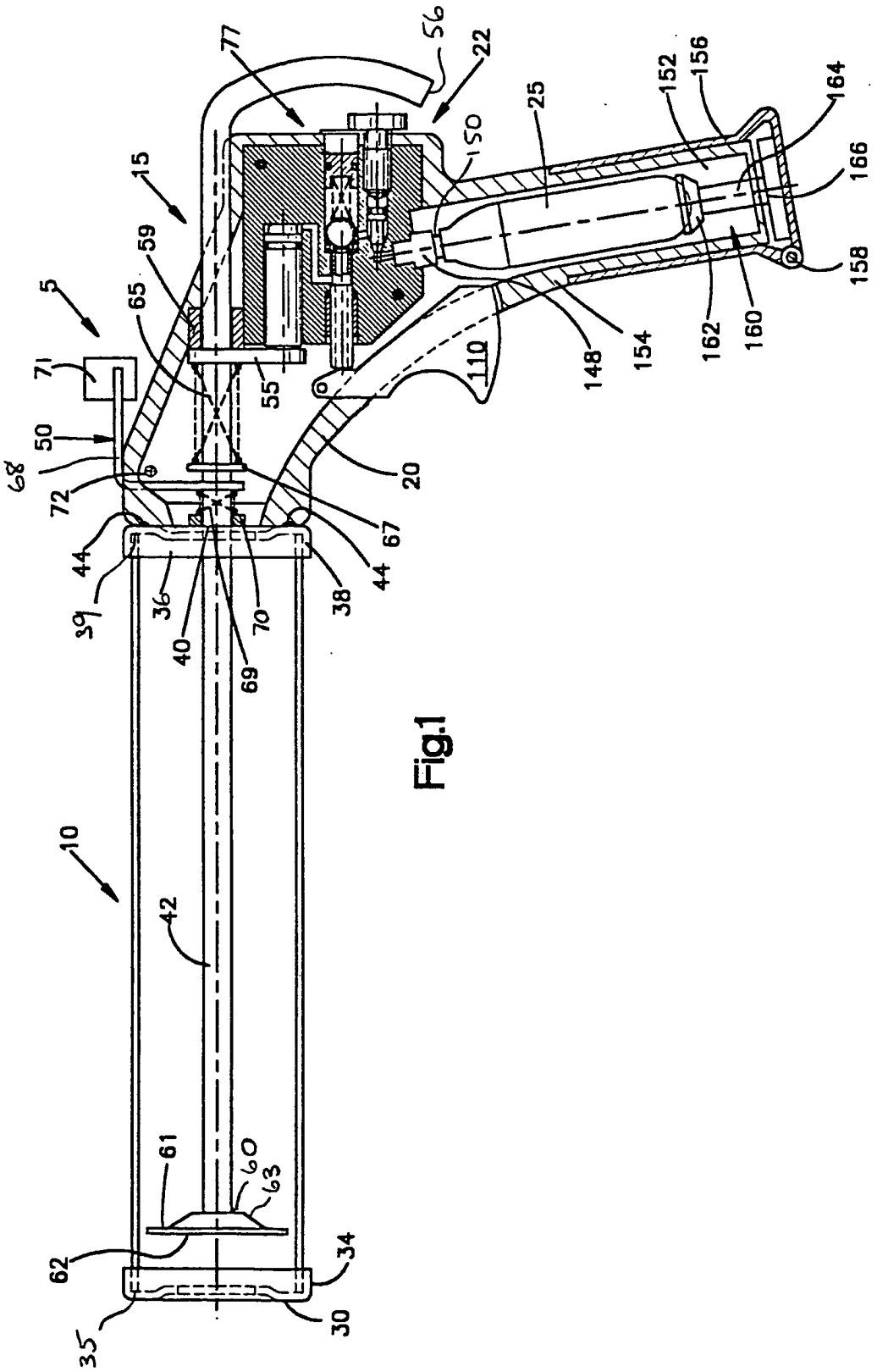
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Fig.1

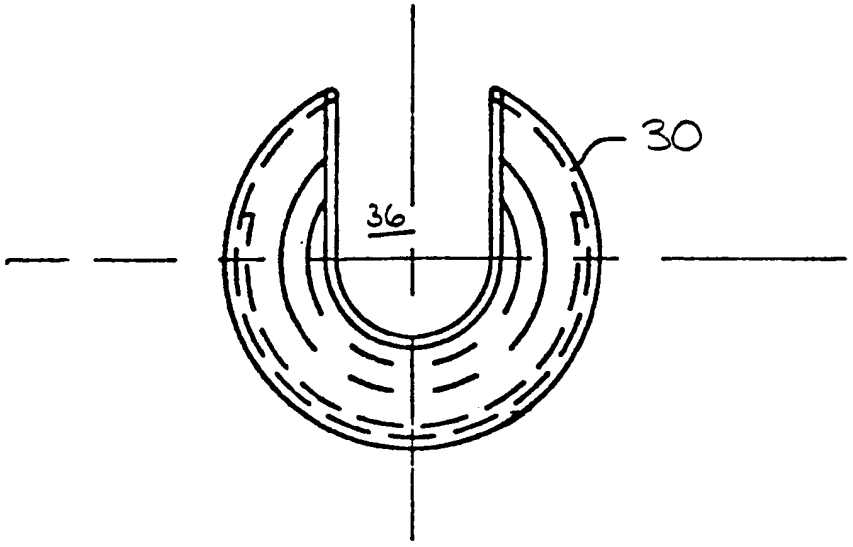

FIG 1A

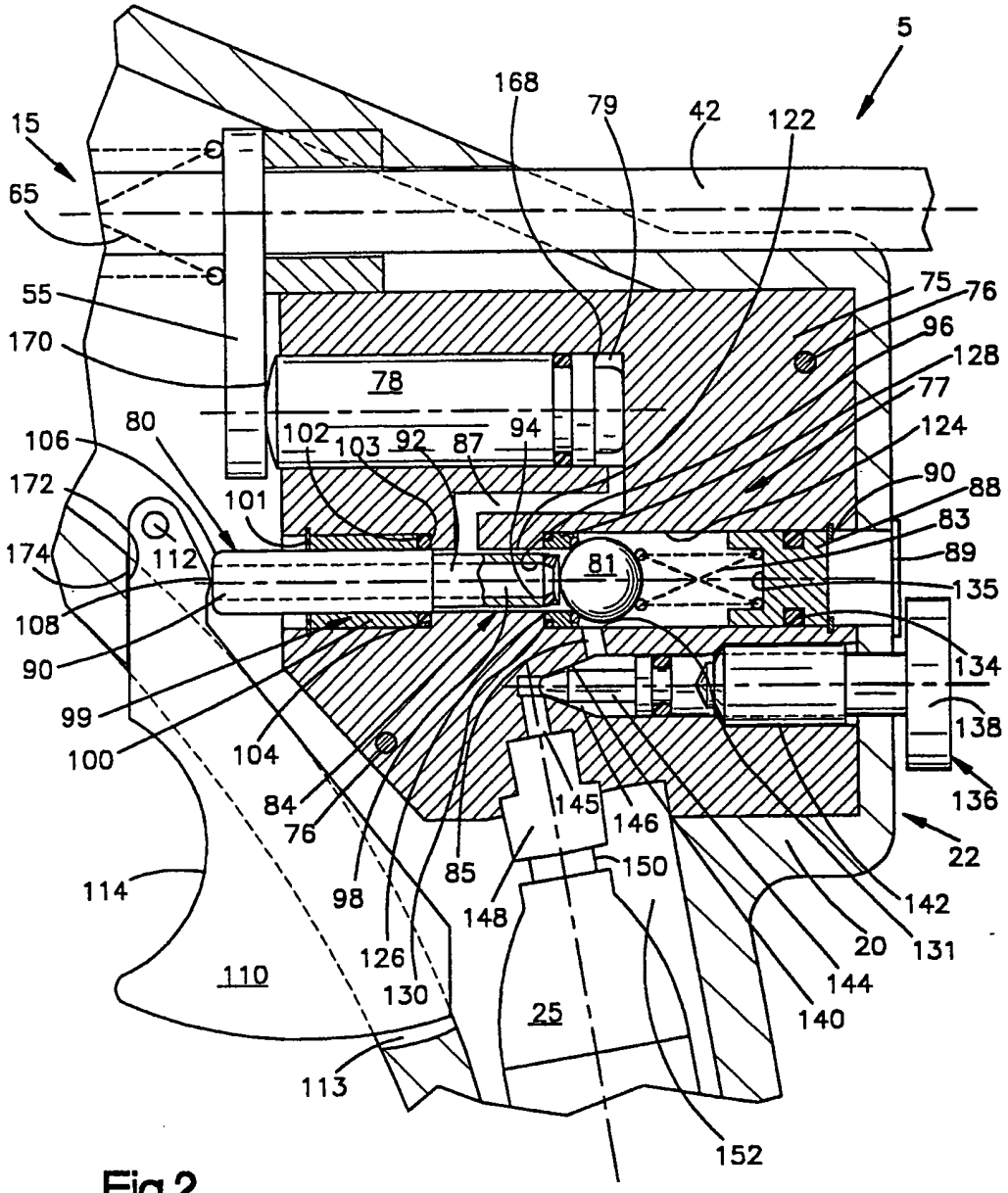
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Fig.2

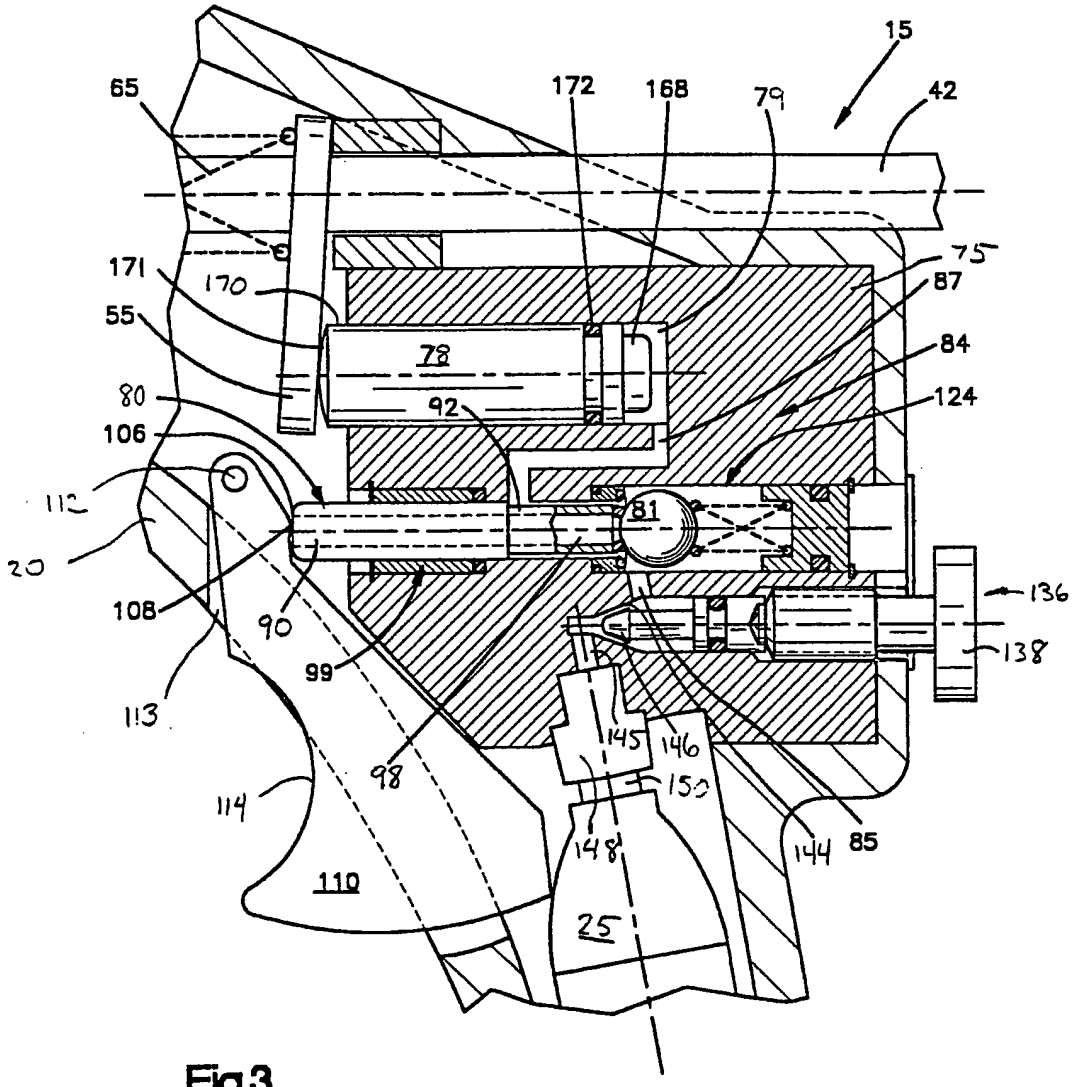
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Fig.3

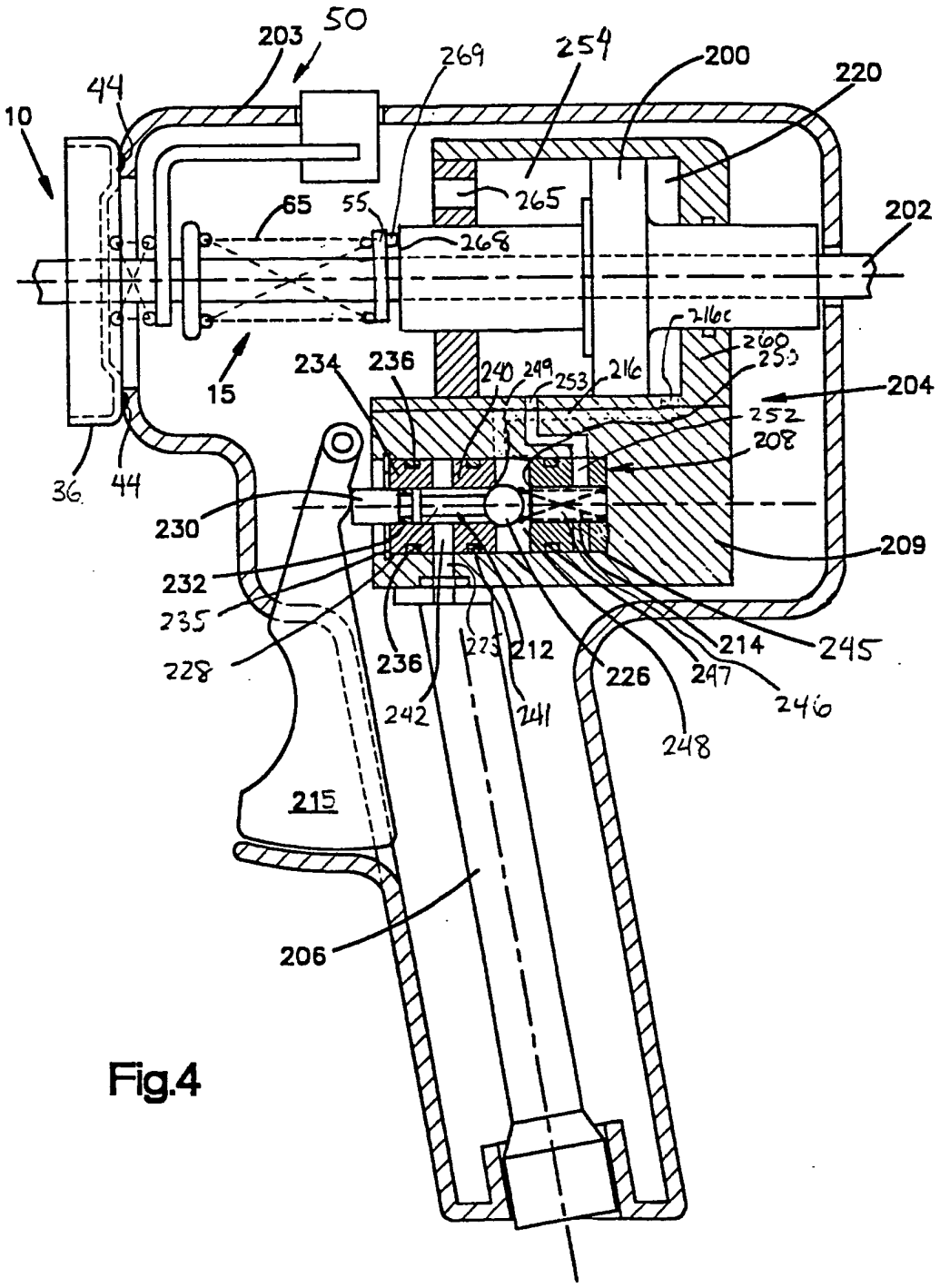
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Fig.4

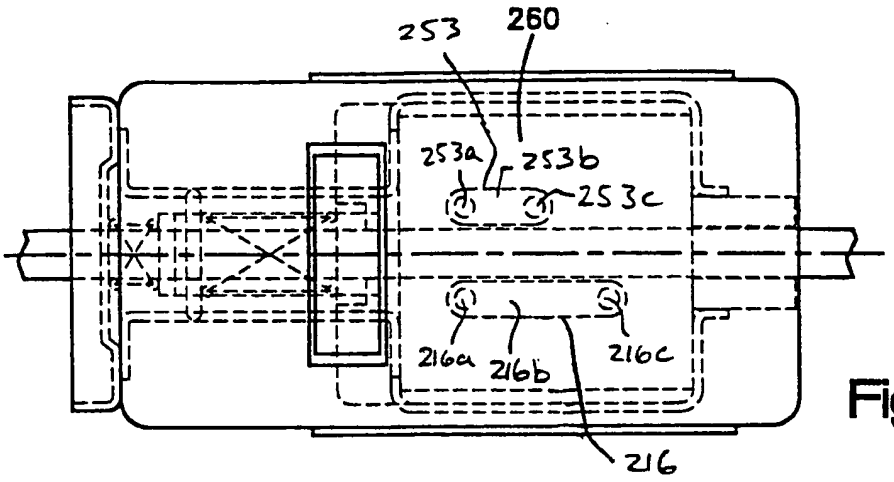
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Fig.5

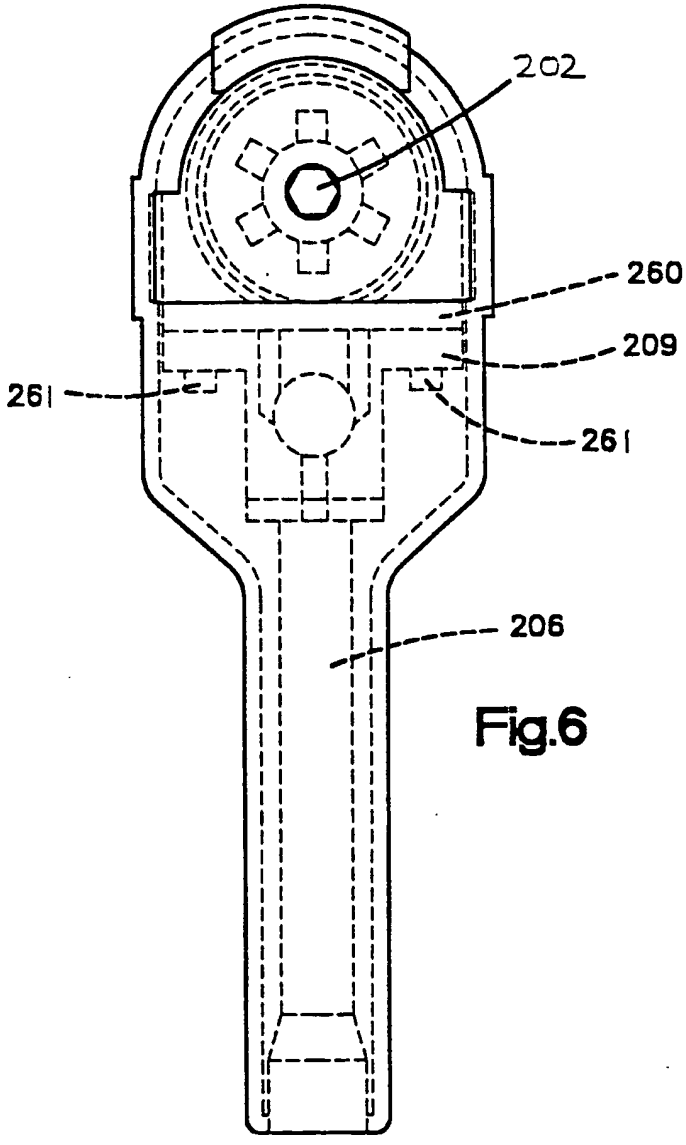
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Fig.6

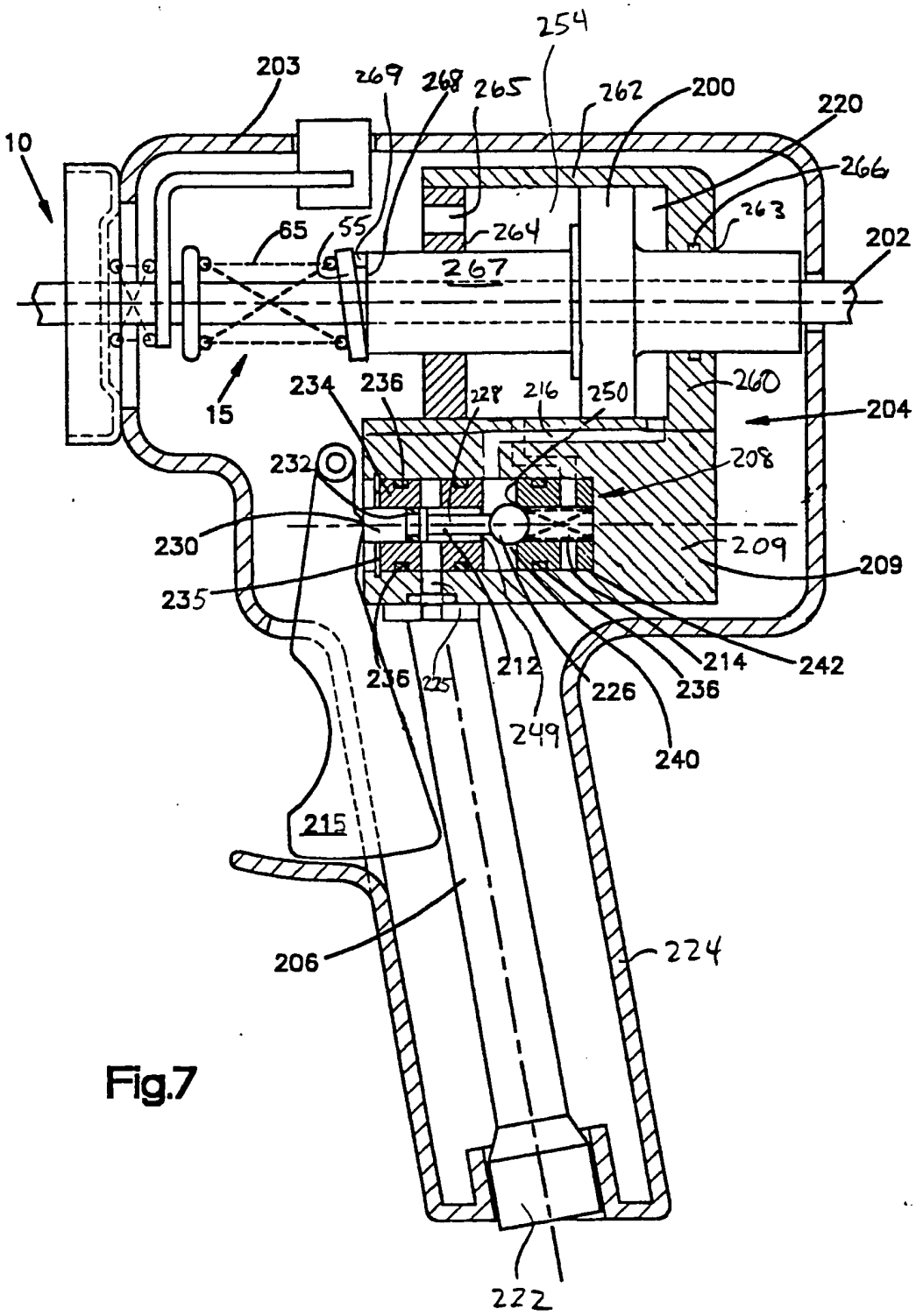
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Fig.7

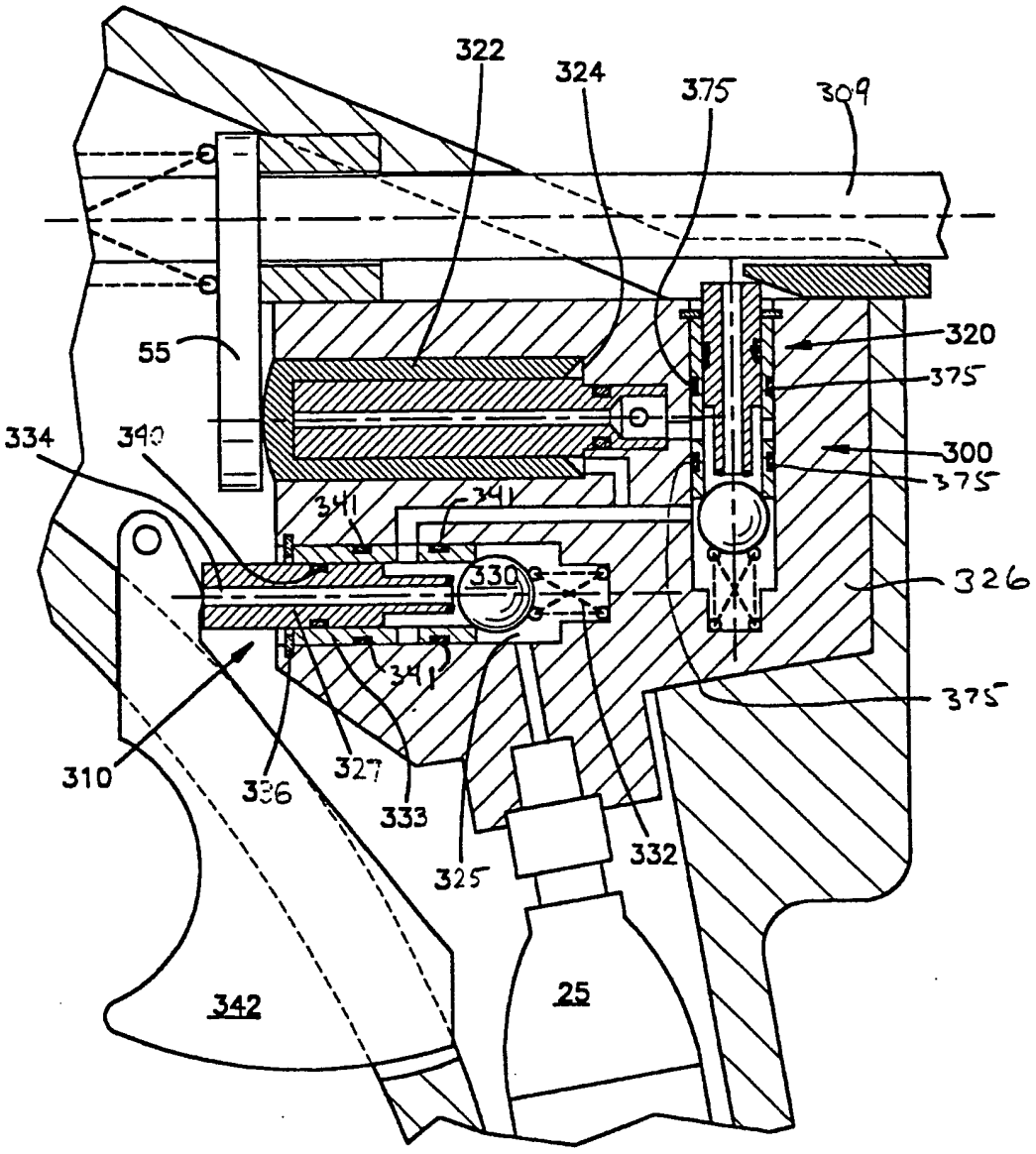
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Fig.8

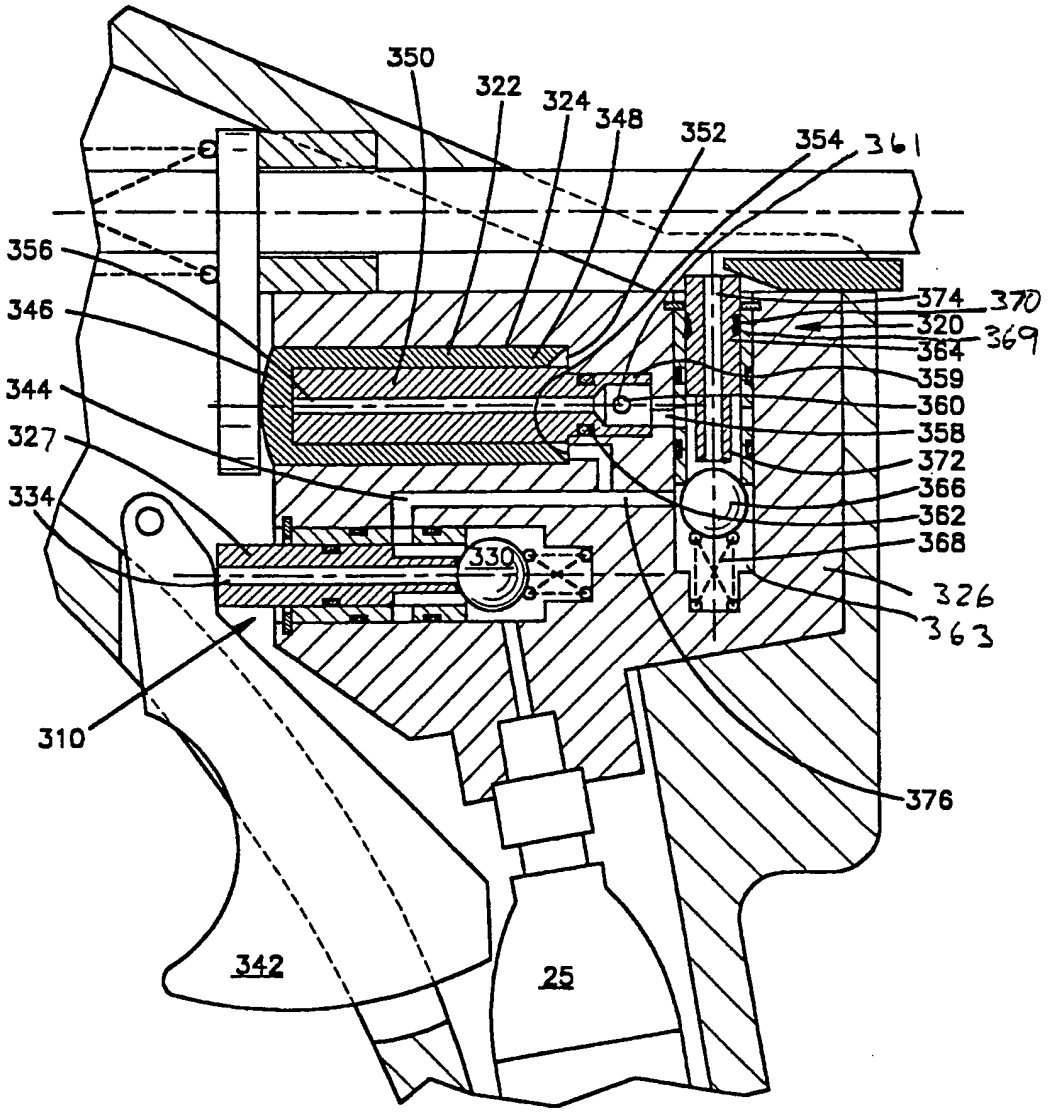
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Fig.9

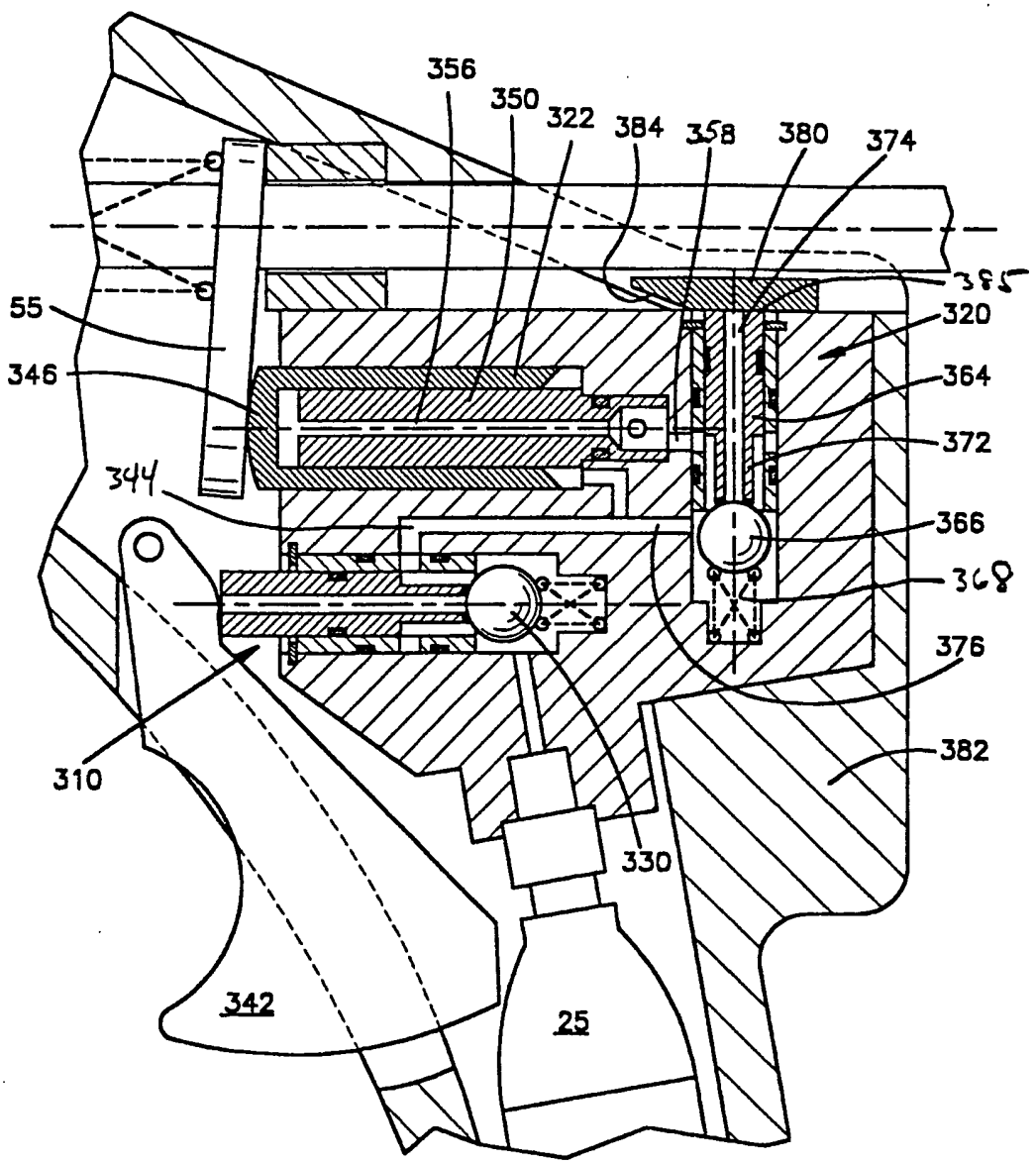
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Fig.10